K. T. S. P. Mandal's Hutatma Rajguru Mahavidyalaya Rajgurunagar 410505

Department of zoology

T. Y. B. Sc

ZO 356: Parasitology

Semester V

By Prof. P. P. Shindekar

Index

Sr. no.	Title	Page no.
1.	Tick	3
2.	Pediculus humanus	10
3.	Xenopsylla cheopis	13

As per SPPU CBCS pattern

Study of tick

Ticks are invertebrates in nature, normally 3 to 5 mm long and they belong to Kingdom Animalia.

Systematic Position

- **Phylum:** Arthropoda
- Class: Arachnida
- Sub-Class: Acari
- Order: Ixodida

There are nearly 18 tick genera and about 850 different species. Ticks are external parasites and their source of feed is the blood of mammals, reptiles, amphibians, and birds. Body of Adult tick is ovoid or pear-shaped, having 8 legs.

They are distributed among two major families, Ixodidae namely hard ticks and Argasidae namely soft ticks.

Hard ticks have their mouthparts at the frontal position, while soft ticks have their mouthparts underlying their body.

The life cycle of a tick is completed after four stages namely egg, larva, nymph, and adult, it requires more than a year to complete a full life cycle.

As per SPPU CBCS pattern



As per SPPU CBCS pattern

Feature	Hard Tick	Soft Tick
Scutum (dorsal shield)	Present	not present
Capitulum (mouth parts)	anterior, visible from above	ventral, not visible from above
Nymphal stages	One	Several
Adult feeding time	several days	30-60 min
Female blood meals	One	Several
Egg laying events	One	Several
Total eggs laid	3,000-8,000	400-500

(SOURCE: https://extension.entm.purdue.edu/publichealth/insects/tick.html)

Stages in the Life Cycle of Ticks

The First Stage (egg)

The adult female tick first fulfills a proper blood meal then the process of mating occurs between an adult male and adult female tick. The female tick then leaves the host and lays eggs in a suitable spot outside the host.

The Second Stage (larva)

The eggs are hatched marking the beginning of a six-legged larval stage within a time span of 2 to 8 weeks. After hatching, the larva then remains on the grass waiting for a suitable host to attach. The odor of the host enables the tick to determine the host to get attached with. After attaching to host the larva feeds upon it and undergoes several stages of molting to transform into a nymph.

Third Stage (nymph)

The larva after feeding on the host for several days acquires a good blood meal and then detaches itself from the host to molt into an eight-legged nymph. The larva molts for two weeks until it develops into an eight-legged nymph and again searches for a suitable host to get attached with for initiation of the next stage.

Fourth Stage (adult)

At this stage, the tick or larva is sexually matured and sufficient enough to reproduce. When it comes to hard ticks, the male and female ticks first acquire a sufficient blood meal and then initiates the process of mating.

Usually, a female tick takes a longer time of feeding compared to the male tick. After the mating process male tick dies, while the female tick dies after laying eggs.

Tick-Borne Diseases

As ticks feed on blood meals they transmit a number of infections to the host caused by pathogens like bacteria, viruses, and protozoa.

Some ticks carry pathogens that can cause human diseases namely.

• Anaplasmosis

Transmitted to humans mainly by the bite of black-legged ticks. It is mainly a bacterial type of disease that attacks the white blood cells in the body. Symptoms include fever, chills, muscle pain, headache, fatigue, and stomach pain.

Babesiosis

It is a protozoan type disease caused by *Babesia microti* parasite mainly transmitted by black-legged ticks. Symptoms include low blood pressure, anemia, and flu-like symptoms.

Colorado tick fever

It is a viral infectious disease caused by the colorado tick fever virus transmitted to humans by Rocky Mountain wood ticks.

• Ehrlichiosis

Transmitted to humans by lone star ticks. Symptoms mainly include fever, headache, nausea, stomach pain, and diarrhea.

Lyme Disease

The most common tick-borne disease is Lyme disease, It is a bacterial type disease mainly caused by deer ticks.

Symptoms include Fever, migraine, cranial nerves palsy, carditis, fatigue, influenzalike illness, and rash, which later gets bigger and appears as a circular red ring.

• Tick-Borne Relapsing Fever (TBRF)

It is also a bacterial type of disease. Transmitted to humans through the bite of infected soft ticks mainly of *Ornithodoros* species. Symptoms include recurring high fever, rigors, headaches, muscle, and joint pain, flu-like symptoms.

Powassan Disease

It is transmitted to humans by groundhog ticks and black-legged ticks. A type of viral infectious disease. Symptoms include fever, headache, vomiting, loss of coordination, and seizures.

• Rocky Mountain Spotted Fever (RMSF)

Transmitted by the Rocky Mountain wood ticks, American dog ticks, and brown dog ticks. Symptoms include fever, headache, myalgia, altered mental status, and rash.

• Tick-Borne Encephalitis (TBE)

It is caused by the TBE virus and is transmitted to humans through infected species of ticks called *Ixodes*.

• Tularemia

Transmitted to humans by dog ticks, wood ticks, and the lone star ticks. Symptoms include fever, skin ulcer, swelling in glands (lymph nodes).

Tick-borne diseases prevention

The risk of tick-borne infections is reduced by avoiding tick bites and removing ticks from the body. Ticks live on the ground and climb 20 to 70 cm onto grasses and bushes where they find hosts with the help of temperature-sensitive cells. The bite is painless, and often you will not sense a tick moving on your skin.

The best ways to avoid tick bites are to:

- use insect repellent on exposed skin;
- wear protective clothing with long sleeves and long trousers tucked into socks or boots; and
- treat socks and trouser legs with permethrin-containing insecticide.

Remove ticks from your skin immediately. Ticks prefer soft skin and hairy areas. Always inspect the entire body for ticks after outdoor activities and remove ticks by pulling them straight out with tweezers or a specially designed tick removal tool, or use your fingers if you do not have the appropriate tools at hand.

Life cycle of *Pediculus humanus*



Note: Lice take several blood meals daily in larval stages and as adults.

Causal Agent:

Pediculus humanus capitis, the head louse, is an insect of the order Psocodea and is an ectoparasite whose only host are humans. The louse feeds on blood several times daily and resides close to the scalp to maintain its body temperature.

The life cycle of the head louse has three stages: egg, nymph, and adult.

Eggs: Nits are head lice eggs. They are hard to see and are often confused for dandruff or hair spray droplets. Nits are laid by the adult female and are cemented at the base of the hair shaft nearest the scalp . They are 0.8 mm by 0.3 mm, oval and usually yellow to white. Nits take about 1 week to hatch (range 6 to 9 days). Viable eggs are usually located within 6 mm of the scalp.

Nymphs: The egg hatches to release a nymph. The nit shell then becomes a more visible dull yellow and remains attached to the hair shaft. The nymph looks like an adult head louse, but is about the size of a pinhead. Nymphs mature after three molts and become adults about 7 days after hatching.

Adults: The adult louse is about the size of a sesame seed, has 6 legs (each with claws), and is tan to grayish-white . In persons with dark hair, the adult louse will appear darker. Females are usually larger than males and can lay up to 8 nits per day. Adult lice can live up to 30 days on a person's head. To live, adult lice need to feed on blood several times daily. Without blood meals, the louse will die within 1 to 2 days off the host.

Prevention & Control

Head lice are spread most commonly by direct head-to-head (hair-to-hair) contact. However, much less frequently they are spread by sharing clothing or belongings onto which lice have crawled or nits attached to shed hairs may have fallen. The risk of getting infested by a louse that has fallen onto a carpet or furniture is very small. Head lice survive less than 1–2 days if they fall off a person and cannot feed; nits cannot hatch and usually die within a week if they are not kept at the same temperature as that found close to the scalp.

The following are steps that can be taken to help prevent and control the spread of head lice:

• Avoid head-to-head (hair-to-hair) contact during play and other activities at home, school, and elsewhere (sports activities, playground, slumber parties, camp).

- Do not share clothing such as hats, scarves, coats, sports uniforms, hair ribbons, or barrettes.
- Do not share combs, brushes, or towels. Disinfest combs and brushes used by an infested person by soaking them in hot water (at least 130°F) for 5–10 minutes.
- Do not lie on beds, couches, pillows, carpets, or stuffed animals that have recently been in contact with an infested person.
- Machine wash and dry clothing, bed linens, and other items that an infested person wore or used during the 2 days before treatment using the hot water (130°F) laundry cycle and the high heat drying cycle. Clothing and items that are not washable can be dry-cleaned OR sealed in a plastic bag and stored for 2 weeks.
- Vacuum the floor and furniture, particularly where the infested person sat or lay. However, spending much time and money on housecleaning activities is not necessary to avoid reinfestation by lice or nits that may have fallen off the head or crawled onto furniture or clothing.
- Do not use fumigant sprays or fogs; they are not necessary to control head lice and can be toxic if inhaled or absorbed through the skin.

Life cycle of Xenopsylla cheopis

Flea, (order Siphonaptera), any of a group of bloodsucking <u>insects</u> that are important carriers of <u>disease</u> and can be serious <u>pests</u>.

Fleas are <u>parasites</u> that live on the exterior of the host (i.e., are ectoparasitic). As the chief agent <u>transmitting</u> the <u>Black Death</u> (bubonic <u>plague</u>) in the <u>Middle Ages</u>, they were an essential link in the chain of events that resulted in the death of a quarter of the population of Europe.

General features

Fleas are small, wingless insects with a tough cuticle bearing many bristles and frequently combs (ctenidia) of broad, flattened spines.

The adult flea varies from about 0.1 to 0.32 cm (0.039 to 0.13 inch) in length and feeds exclusively on the <u>blood</u> of <u>mammals</u> (including humans) and <u>birds</u>. With about 2,000 species and subspecies known, the order is still a small one compared with many other groups of insects.

However, it is widely distributed with some—such as the <u>rat flea</u> and the mouse flea—having been carried all over the world by humans. Native species of fleas are found in polar, <u>temperate</u>, and tropical regions.

Certain fleas that feed primarily on <u>rodents</u> or birds sometimes attack people, particularly in the absence of their usual host. When <u>rats</u> are dying of <u>bubonic</u> <u>plague</u>, their hungry fleas, themselves infected with plague <u>bacilli</u> and seeking food elsewhere, can <u>transmit</u> the disease to humans, especially in buildings heavily infested with rats. The Oriental rat flea (*Xenopsylla cheopis*) is the most efficient carrier of plague, but other species of fleas.

Although there are occasional cases of <u>plague</u> in tropical and some temperate regions, the disease in humans can be controlled by early <u>diagnosis</u> and <u>antibiotics</u>.

Plague (sylvatic plague) is a widespread disease in hundreds of species of wild rodents throughout the world and is maintained in those populations by fleas that parasitize these <u>animals</u>.

More than 100 species of fleas are known to be able to be infected by the plague bacillus, and an additional 10 species are <u>implicated</u> as carriers of the classic type of urban plague. (*See* <u>infection</u>.)

Fleas, particularly *Xenopsylla cheopis*, are thought to be the principal carriers of murine (endemic) <u>typhus</u>, a rickettsial disease of humans.

As in plague, rats and <u>mice</u> are the sources of infection..

Life cycle

Details of the life cycle are available for only a few species. The four life stages are the egg, <u>larva</u>, <u>pupa</u>, and adult.

Pearly white oval eggs are deposited on the body of, or in the nest or <u>habitat</u> of, the host <u>animal</u>.

The **larva** is small and legless and feeds on organic debris, such as dried excrement, dried bits of skin, dead mites, or dried <u>blood</u> found in the host's nest. The adult fleas pass freshly imbibed blood rapidly through their gut to produce fecal matter for the nourishment of their offspring, which is essential to the successful <u>metamorphosis</u> of certain species of flea larvae. After three (exceptionally, two) <u>molts</u>,

the larva spins a <u>silk cocoon</u> that includes debris from the nest and enters the pupal stage. The pupa emerges as an adult some days or months later. Some species can enter an arrested state of development at the end of the pupal stage and will not emerge as an adult until a host is present.

Depending upon the species or environmental conditions, the time required for a complete <u>life cycle</u> varies from two weeks to several

Control

In controlling fleas it is best to treat simultaneously both the host nest or bedding area, which is the breeding site of fleas, and the infested host, since the larval and pupal stages usually develop away from the host's body. For infested animals a commercial dust, spray, dip, or aerosol containing an <u>insecticide</u> or growth regulator is used. However, in some regions, fleas have become resistant to some insecticides, and new materials are required. For the control of larval and adult fleas away from the host, insecticides or growth regulators may be applied to the pens and haunts of the affected animals. Repellents may be effective in preventing attack by fleas.

